

MATHCOUNTS Coaches' Handbook

Thanks to the primary contributors to this handbook: Rich Morrow, Rhonda Wanger, Nancy Depew and Kathy Miles. Their dedication to the MATHCOUNTS program as coaches and so much more is greatly appreciated. Some contributions were lifted word-for-word. Others may recognize something you do or say that has landed on these pages. Thank you to all the coaches who have, over the years, shared their experiences so freely with each other. Learning together is the true spirit of MATHCOUNTS.

With your help, this resource can continue to grow and evolve. We welcome your ideas and contributions. Send to mathcounts@nspe.org (subject line: Coaches' Handbook suggestion).

WELCOME TO MATHCOUNTS!

You generously volunteered your time to help students, but you'll find that you'll get hooked on MATHCOUNTS yourself! You'll learn, along with your students, to cut a Godzilla of a math problem down to size. You will be awestruck when your students come up with their own elegant solutions. And you'll see true teamwork move from ideal to reality.

MATHCOUNTS coaches are a very sharing bunch. We've developed this handbook to help you through your year in coaching. This is just a starting point, however. Don't hesitate to post a message on the Coaches' Corner (one of the Meeting Places at <http://mathcounts.org>) if you have a specific question. You'll be amazed at the number of coaches eager to help you. They'll even share what it was like as a beginning coach.

Finally, there are some **decisions that you will have to make** – the obvious ones like when and where to meet, as well as the more difficult ones like how to select your final team and if/when to pare your group down as competition season nears. There is no “official” MATHCOUNTS line on these issues. It's your decision as a coach, and there are many examples of successful programs – each different.

THE IMPORTANCE OF FOOD

Yes, food is that important to a successful MATHCOUNTS program that it comes first in our handbook. Someone who turns out to be your most valuable team member may come to the first meeting not sure what MATHCOUNTS is all about, but definitely sure that he/she loves brownies. For that reason, all the publicity about your first meeting must include mention of the mouthwatering snacks you'll be serving. This is middle school, after all!

At the first meeting, **make up a snack schedule** so students take turns providing snacks. Of course, you could always tap a parent to oversee the operation of the food chain. Ideally the students should be reminded of their responsibilities before their turn. One coach had this so fine-tuned that the snack list was divided into a sweet snack and a salty snack.

And don't hesitate to **use treats as rewards**. If you have a warm-up at each meeting, the table/group with the correct answer(s) could get to eat first. Successful memorization of all the primes could merit a candy bar. The ways to bribe students with food are endless!

HOW TO GET MATHLETES / HOW TO KEEP THEM

Besides the obvious lure of food, there are other ways to get students involved:

Ask a Student to Join – Approaching a student individually is blatant, but often successful. Sometimes a very shy student needs only to be asked. Also let students know they can come even if they have no desire to officially compete. (Remember, the ultimate goal is learning, not necessarily winning.)

Ask a Group of Students to Join – A student may join if his/her friends will be there. This is a way to encourage participation by under-represented groups.

Enlist the Best Scouts: Other Math Teachers – Provide other teachers in your school with plenty of information about MATHCOUNTS (the program, its resources and your meetings). Visit individual classrooms if you can.

Incorporate MATHCOUNTS into your class and tell kids when you do. Provide other teachers with copies of the “Problem of the Week”. Get them hooked.

Tell Groups About MATHCOUNTS – Speak at PTA meetings, Gifted and Talented Meetings, Back-to-School Orientations, Parents’ Night, etc.

Although the competition phase of MATHCOUNTS now incorporates sixth-, seventh- and eighth- graders, most successful coaches focus on **recruiting sixth graders**. You have a better chance of keeping them if you can get them first. There’s less at stake for the student – any mistakes are due to their being new to the program and the youngest. The group of students will have more of a chance to bond together. And – here’s the math – by competing in the sixth grade, they can learn more in three years than in two.

Students stay in MATHCOUNTS because they want to. Some students love math itself so much that providing challenging problems each week is all you have to do to keep them interested. Other students need to build to this level. **Provide a supportive atmosphere where all students feel free to take risks.** Publicize often, within the school and in the local newspaper. Some clubs have end-of-the-year awards dinners/cookouts/swim parties. Field trips, bowling or skating outings during the year also build bonds.

HOW OFTEN / WHEN SHOULD WE MEET?

The most obvious answer is once a week, after school. There are lots of variations on this theme, but for most, this is it. Yes, we’d love to meet every day after school, but students are in other activities, you have other responsibilities (and hopefully a life), and even managing to meet once a week with team members sometimes requires a lot of effort.

To try to **head off conflicts with other activities**, do two things: talk beforehand to other club sponsors to create as few conflicts as possible and start your meetings as soon as the school year starts – hook ‘em BEFORE they even know the other clubs exist. And when the inevitable conflicts come, **be as flexible as possible.** Sometimes team members can contribute a lot by coming to the meetings they CAN make. Your most valuable member may be someone who alternates coming to MATHCOUNTS with being a reading tutor. Also, if you’re cooperative before the big band concert, you can expect the favor to be returned when competition time comes around.

Now for the variations on a theme – sometimes it’s necessary to **practice at other times**: maybe getting kids to stay after school is difficult, maybe you need additional practice. There are some schools where it’s possible to have a MATHCOUNTS **class during the day**, but this is not an option for most teams. Some teams get creative by getting administrative approval for a **MATHCOUNTS homeroom** on a daily or weekly basis. Other teams practice before school (with donuts, of course!). A few dedicated teams practice on **Saturday mornings**. (As one veteran winning coach said, “It’s their soccer!”) By exploiting the sacred tie-in between MATHCOUNTS and food, you may even get kids to come in at lunch, if you can top the cafeteria food. Another idea is to have special long practices (pizza scrimmages?) before meets or competitions. Finally, getting together over the summer with fun math activities often can keep the team running.

Here’s something a lot of the best teams do – they **practice with other teams** on a regular basis. Many teams have regularly scheduled math meets during the school year. Students never pay as much attention as when they miss a problem in competition. If your school district doesn’t do this already, request that your math supervisor start a math meet. You can start the ball rolling by suggesting the framework for the event (problem sets, format, etc.) and/or contacting other coaches in your area to get them to buy into the idea. Find them by searching the MATHCOUNTS registration database (see <http://mathcounts.org>).

Many school districts also have a **special daylong practice prior to the Chapter Competition**. And some do this on a citywide or district-wide basis. Check with civic and professional associations (like the Jaycees) or local businesses (like Target) for support/space. Ask your principal/supervisor if funds are available for substitute teachers. Your gifted program can also be a source of funds/support.

One other big consideration is to decide whether you want the rookies to practice with the veterans or the just-there-for-the-fun students to practice with the budding geniuses. Breaking the group into two or having the groups meet at different times may be a solution, or you may want to keep all the students together. Brighter students can often learn as much by showing others as by doing for themselves. At times like these, it’s great to have a co-coach available to give you more flexibility. **Don’t be shy about enlisting a former Mathlete, parent or even a non-math teacher to help out!**

New coaches may wonder about their **relationships with other coaches**. Simply put, they are more like you than anybody else in the world. They teach mathematics (even if it’s only to Mathletes), they care enough to help their students, and they want to know the same things about contest, motivation, accomplishments, etc. MATHCOUNTS coaches are more than willing to share their ideas with you – seek them out, in person or through the Coaches’ Corner. They can be your best friends.

WHAT SHOULD WE DO WHEN WE MEET? — PART 1: FORMAT

The possibilities are endless!

You’ll find that it’s not enough just to hand out a Warm-up or Workout from the *School Handbook*. Most coaches will usually **introduce a new topic** at the beginning of the coaching session. This may be a new topic for your MATHCOUNTS students (factorials, for example), or one that you think will be motivating – most students are amazed to find out that you can add the numbers from 1 to 100 in less than 30 seconds! On another occasion, it might be time to **review some basics**, like the list of primes under 100. In any case, try to pick a topic your students will see on that day’s Warm-up or Workout.

Warm-ups and Workouts are presented in shotgun fashion. The questions on one Warm-up will cover many different topics. While this may initially be bewildering to some students (and coaches), **resist the temptation to do only one type of problem at a meeting.** Eventually your students will start to recognize different types of problems (“Oh, this looks like a triangular number pattern!”), rather than think only in terms of the problems they’ve just been working on.

Once you hand out a Warm-up/Workout, it is often helpful to have students read the entire page and then:

- Explain any vocabulary terms that are new or unclear
- Mark easy problems (for beginners) and challenging problems (for veterans or gifted students)
- Highlight key phrases such as “express the answer as a mixed number”

Some coaches also **create custom worksheets** using previous years’ problems (either from their own library or purchasing past years’ MATHCOUNTS materials from Sports Awards online at <http://mathcounts.org>), problems from different math competitions or problems suited to the ability level of their students. To facilitate this task, some coaches also utilize the database of MATHCOUNTS problems, available from EducAide Software (www.educaide.com).

Teamwork is one of the essentials of a good MATHCOUNTS program. Working together on Warm-ups and Workouts is a great way to develop teamwork. Because the problems are challenging, the answers are not usually readily apparent, so there’s room for a lot of give and take. Ignoring one person in the group can mean missing the answer to the problem. One good idea to ensure that everyone participates is to let the students take turns presenting the answers at the front board with a complete explanation. **Encourage multiple methods for arriving at the answer**, and explain to students what an “elegant” explanation is.

Some coaches feel more comfortable working out the answers ahead of time. Solutions are in the back of the *School Handbook*, and coaches have found these explanations invaluable. It is also valuable sometimes to deliberately NOT work out the answers ahead of time. If there is a particularly challenging question, **let your students see what you do when you don’t know the answer right away.** Modeling this behavior is a powerful lesson. If you are lucky enough to co-coach, students will enjoy seeing the different ways two people approach a problem. And of course, it is very gratifying for the student to teach the teacher and point the way to a solution.

One of the first things your students will learn when doing MATHCOUNTS problems is that if a problem looks impossible or looks like it would take too long to do, there’s a different way of looking at it or approaching it that will turn it into a simpler problem. **Take time to go over the problem solving strategies presented in the *School Handbook*** (and at <http://mathcounts.org>) – students need to be just as familiar with these as they are with their times tables. Or create a bulletin board/poster where problem-solving strategies can be listed as students discover them.

Since the MATHCOUNTS experience eventually ends in a competition for some students, many coaches **incorporate some degree of competition into meetings, with an emphasis on fun and success** rather than pressure and losing. It can be as informal as letting the first group that correctly answers a math question get snacks first. It can be as regimented as keeping a running tally of individual scores for even-numbered Warm-ups. One teacher plays math baseball during summer get-togethers, where answering questions results in advancing from base to base. Staging a mock Countdown Round (available in PowerPoint format at <http://mathcounts.org>) using your own questions or questions from previous years’ Countdown Rounds will give your students an advantage when the real thing comes along. Some (not all – no stereotyping here) girls shy away from competition – possible solutions are to divide into small teams or pairs to compete, or having a girl vs. girl round.

Finally, be aware that some teams have “**homework**” to be done between meetings. This way the team has a head start at the next practice and can focus on the really hard problems and their solutions.

WHAT SHOULD WE DO WHEN WE MEET? — PART 2: CONTENT

Again, the possibilities are endless!

There are **basics every Mathlete should know**, and some coaches have compiled this information and gladly share it with others. One example is “The MATHCOUNTS Bible According to Mr. Diaz: What you must memorize, without excuses and for the rest of your lives (not just for MATHCOUNTS).” A link to this document on the Internet can be found in the Other Sites/General Interest Math Sites area at <http://mathcounts.org>. Some basics are topics that your students have been exposed to but not necessarily mastered, like percent equivalents or the list of primes under 100. (Don’t assume that a student in the top math class will know that the number one isn’t prime.) **Play games, give quizzes, offer rewards, but make sure your students know these basics.** The top teams do.

Depending on the curriculum of your school district, there are some topics in MATHCOUNTS that your students may not have encountered yet but will definitely need. It is important to note that although sixth graders are eligible to compete, the competition materials are geared to seventh- and eighth-grade curriculum. Some challenging topics may include:

- simplifying radicals
- Pythagorean Theorem
- not-the-usual- area formulas (rhombus, area of a square given the diagonal, etc.)
- Triangular numbers (and other neat formulas like # of diagonals, # of factors, sum of factors, etc.)
- 30-60-90 and 45-45-90 triangles
- not-the-usual divisibility rules (7,11, divisors of ABCABC)
- permutations and combinations, probability
- loads of geometry theorems (medians, angle bisectors, etc.)

Typically, there is more geometry in MATHCOUNTS problems than students usually get in class. There is also a lot of material they’ve already had, but don’t recognize, because they’re seeing it in a different place, mixed up with other types of problems, not at the end of Chapter Four where they last saw it.

The *School Handbook* has a large **vocabulary list** that lists just about any topic you’ll encounter in MATHCOUNTS. Get your students involved in looking up these terms and explaining them to the group. The *School Handbook* also has a list of resources that includes materials (such as *Favorite Problems, Grades 5-7*, by Dale Seymour) that will introduce your students to some of the “tricks” used to solve problems that appear very difficult. And don’t forget the additional resources available from MATHCOUNTS, such as the *All-Time Greatest MATHCOUNTS Problems*.

Finally, since some of the MATHCOUNTS problems allow the use of a calculator, make sure your students **know how to get the most out of a calculator**. For example, you can use a TI fraction calculator to find if a number is prime. Students should know when to use the integer divide key. Your students should also know the idiosyncrasies of the calculators they use – does the square root button get pushed before or after the radicand? Though these topics should be addressed in regular math class, you don’t want to stake your math team’s competition score on it.

TEAM DYNAMICS

MATHCOUNTS provides the opportunity for individuals to be successful, but they learn they can be most successful as part of a team. **Good team building will keep kids in MATHCOUNTS.**

A coach is a cheerleader for MATHCOUNTS. **A successful coach believes that a team plays together first, has fun and develops teamwork.** Team members bond as they share their special interests, their accomplishments and even their stresses. If the coach models hard work, the teammates will follow.

One coach starts the year off by having those who were MATHCOUNTS members and/or competitors tell about their experiences from the previous year. Another approach is to have students sit in a circle and compliment the person on the right. This “complimenting” is then done with different variations after every meeting. For example, it may be filling in a blank sheet for each student with positive comments. It all culminates with collecting compliment cards as a good luck token before a meet. Combine these types of opening (“So what did you do that was fun since the last meeting?”) and closing activities and students get to know more about each other and build friendships and appreciation for each other.

Encourage team members to look out for each other mathematically. On a soccer team, if someone needs help on corner kicks, it’s to everyone’s advantage if that person gets more practice. On the math team, try to get all the students to help you **coach to their weaknesses.** (Probability frequently falls into this category.) Your students should also **recognize each other’s strengths,** to the point where they can assign problems on Team Rounds to each other based on that knowledge. What about a team member with no outstanding strengths? One coach had a good job for a weaker member on a team of powerhouses – check the answers. This is not really a cop-out job – a student may not know how to arrive at an answer to a problem, but can usually check to see if it’s right or check for “careless” mistakes.

Mistakes? Learn to live with them. They’re not going away, so a creative coach finds a way to get the most mileage out of them. After your students have gone over the day’s problems, why not ask them to pick out the most helpful wrong answer of the day?

And finally, try to **enlist the help of former Mathletes.** Keep them informed via a newsletter and have them come back to share their experiences with current participants/competitors. Ask them to participate in coaching sessions and special events. Have a recurring activity each year (maybe a picnic, a bowling outing) where it’s a tradition for the “alumni” to show up. They can share the future benefits of MATHCOUNTS with your students – those dreaded SAT’s will be a piece of cake after a vigorous MATHCOUNTS program!

COMPETITION TIME

The MATHCOUNTS program involves coaching at the school level, a School Competition, Chapter Competition, State Competition and then the National Competition. Obviously **not all your students will be able to compete** – only eight (a team of four students and up to four additional individuals), sixth-, seventh- or eighth-graders may officially represent your school at the chapter level. Advancement to the state level varies from program from program, but must be consistent within the chapter. The *MATHCOUNTS School Handbook* will provide you with the general rules and procedures that govern the competitions.

What it won't tell you is **how to select your team**. You'll notice that the term "top four" was not used in the first paragraph. Everyone has stories about the "one that got away" – because of illness, a conflict with another competition, bad team spirit or just a choice that in retrospect wasn't the best. You may have an individual who outscores a team member in the actual competition. So first, remember the immortal words of Captain Kangaroo, "The best I can do is the best I can do, and I'm doing the best that I can." He obviously didn't have MATHCOUNTS in mind when he said it, but you'll find that it comes in handy in a lot of circumstances.

At some point you will have to narrow your group down to include four who will represent your school as the official team and up to four additional individuals. Depth is important. Flu happens. Some coaches narrow their group down in December, some earlier, some later. Some coaches continue to have the rest of the MATHCOUNTS group continue coming to meetings, some don't. If this sounds like a cop out, it's not. It really is your decision as a coach. It's not the principal's decision or a parent's decision. What will help, though, is to communicate to parents what your process will involve.

Team selection can be ongoing, based on performance during the year. Some coaches use a point system, based on the number of Warm-ups/Workout problems completed, performance in other competitions, etc. An advantage of this system is that a student has to earn his/her way onto the team by continual hard work over the course of the year, and that students can always come back after a disappointing performance. Some coaches **use the MATHCOUNTS School Competition** to determine the competition team and individual competitors. Some even open up the School Competition to all students in the school and don't restrict it to just MATHCOUNTS members.

Then there is the **"go with your gut" method**, which can be used alone or to override any of the above methods or combinations thereof. It should not be underestimated. It is especially important when considering how well members will function with each other as a team.

Someone once remarked that when a football team wins the Super Bowl, even the players who sat on the bench are a part of the winning team. Make sure all your club members know if the top four to eight who go on to competition do well, it will be because of how well they practiced with the other MATHCOUNTS members. Every member of a school MATHCOUNTS program should feel a part of every win.

THE LAST WORD

You obviously know about the MATHCOUNTS website (at <http://mathcounts.org>) or you wouldn't be here. You will come to love the "Problem of the Week" as a never-ending source of extra credit. The "Go Figure! Math Challenge" will be the computer break your kids will love. And there are many other valuable resources, from problem-solving strategies to links to other math-related websites. But the Coaches' Corner can be your lifeline. It has been said elsewhere, but it's a resource you really can depend on. Even if you don't have a problem, reading current postings or looking at old ones in the archives will make your coaching experience richer. And to quote Dr. Seuss, "Oh the people you'll meet!"

ONE LINERS TO COACH BY

Finally, we leave you with some of our favorite sayings:

“If you aren’t confused, you haven’t been thinking!” —Rich Morrow, Colorado

“Great minds think alike – not necessarily correctly, but alike!” —Mary O’Keeffe, New York
(Comes in handy when you and a Mathlete both get the same wrong answer.)

“If we already knew the answer, we wouldn’t be here!” —Rich Morrow, Colorado

“When you don’t know something, think of something you do know!” —Kathy Miles, Maryland

“Answer the question asked, not the question you would ask.” —Dan Mirus, Ohio

“You can’t be better without being different.” —Rich Morrow, Colorado

“When you’re stuck, give something a different name.” —Kathy Miles, Maryland

“My job is to make your life miserable – your job is to make me look good!” —Nick Diaz, Maryland

“If you think you can’t do this, you’re probably right!” —Nick Diaz, Maryland

“MATHCOUNTS cheer: Crunch ‘em up, Crunch ‘em up – NUMMM-BERS!” —Brook Randal, Texas

“If you had fun – you won!” —Kathy Miles, Maryland
(Comes in handy after a competition.)
